

it that the existing hammers were incapable of forging a wrought-iron shaft of thirty inches diameter? Simply because of their want of compass, of range and fall, as well as of their want of power of blow. A few moments' rapid thought satisfied me that it was by our rigidly adhering to the old traditional form of a smith's hand hammer—of which the forge and tilt hammer, although driven by water or steam power, were mere enlarged modifications—that the difficulty had arisen; as, whenever the largest forge hammer was tilted up to its full height, its range was so small that when a piece of work of considerable size was placed on the anvil, the hammer became 'gagged'; so that, when the forging required the most powerful blow, it received next to no blow at all, as the clear space for the fall of the hammer was almost entirely occupied by the work on the anvil.

"The obvious remedy was to contrive some method by which a ponderous block of iron should be lifted to a sufficient height above the object on which it was desired to strike a blow, and then to let the block fall down upon the forging, guiding it in its descent by such simple means as should give the required precision in the percussive action of the falling mass. Following up this idea, I got out my 'Scheme Book,' on the pages of which I generally *thought out*, with the aid of pen and pencil, such mechanical adaptations as I had conceived in my mind, and was thereby enabled to render them visible. I then rapidly sketched out my Steam Hammer, having it all clearly before me in my mind's eye. In little more than half an hour after receiving Mr. Humphries' letter narrating its unlooked-for difficulty, I had the whole contrivance, in all its executant details, before me in a page of my Scheme Book, a reduced photographed copy of which I append to this description. The date of this first drawing was the 24th November, 1839."

The paddle-wheel of the *Great Britain* was, however, never forged, as about that time the substitution of the screw for the paddle-wheel as a means of propulsion was attracting much attention. Indeed, Mr. Nasmyth could get no English firm to take up his invention, and was naturally surprised to find, on a visit he made to France in 1842, that his steam-hammer was in full operation at Creuzot, M. Schneider having copied the design from Mr. Nasmyth's drawing when on a visit to Patricroft. Very naturally Mr. Nasmyth on his return to England lost no time in protecting his invention by patent; its career since is well known.

As we said, Mr. Nasmyth retired from business in 1856, twenty-eight years ago, bought a "Cottage" in Kent, a picturesque place near Penshurst, to which he gave the characteristic name of Hammerfield. Long before this he had learned to take an interest in science, especially in geology and astronomy. His investigations into the structure of the moon are well known, and these, as well as his examinations of the sun's surface, have been conducted with telescopes of his own construction. His elaborate work on the moon, with its magnificent series of views of its surface, has long been classical, and his contributions to the subject of the sun's heat are well known. His imagination, when not engaged in devising mechanical contrivances and contributing to scientific theory, has often blossomed into fancy which has found expression in exquisite pictures of fairy-land and other regions of the unseen. Altogether Mr. Nasmyth's long life has been one of almost unchequered success; from the first he has clearly seen what he wished to accomplish, and with scientific precision has devised the most effective means of realising his aims. Not the least

delightful and instructive of his many works is the one before us, which we commend to the study of all young engineers, as well as to all who wish to read the story of a successful life simply and pleasantly told.

John Duncan's career, as told by Mr. Jolly, is a complete contrast to that of Mr. Nasmyth. He never rose above the humble station in which he was born, nor apparently ever wished to do so. He had all along to struggle for a bare living, and was essentially unpractical. What little education he had was self-acquired, and it was never much so far as book-learning goes. His love of flowers was a passion. He amid many discouragements managed to acquire a mastery of systematic botany, and his collection of Scottish plants, now in the possession of Aberdeen University, is of real value. Every moment he could spare was devoted to adding to his collection, and partly as weaver and partly as harvester he traversed most of his native land. In other respects he was a man of superior mind, though in no sense a genius, and by no means to be compared with Robert Dick or even Thomas Edward. Mr. Jolly has narrated in our own columns the main facts of Duncan's career. Had he been more happily situated he would certainly have done real service to science. It is some consolation to think that his merits were recognised before he died, and that his last days were surrounded with comforts and attentions to which throughout his previous life he had been a stranger. As we have said, Mr. Jolly has made too big a book of the materials he has collected, and although it abounds in interest, it would have been more creditable to his literary skill had he taken the trouble to rid it of redundancies.

THE HEAVENLY BODIES

The Heavenly Bodies; their Nature and Habitability.

By W. Miller, S.S.C. Edinburgh, Author of "Wintering in the Riviera." Pp. 347. (London: Hodder and Stoughton, 1883.)

FEW subjects could be mentioned more remote from the common interests and pursuits of life than what has been usually called the "plurality of worlds," an expression now so long restricted to one well-ascertained meaning as to have lost any ambiguity that might have been charged upon it. The question is one of mere curiosity, and leads to no direct result; but it has always carried with it an attraction irrespective of its unpractical nature, and has exercised the ingenuity of so many minds that its literature is of no inconsiderable extent. To this the book now in our hands is the most recent contribution. It is not the work of an astronomer, as the author himself has informed us; but as his profession leads him to the examination of evidence this need not be considered a material disadvantage. His position, however, in this respect would have been improved by a little more care in the collection of his data, which in some instances, such as Mädler's "central sun," the satellites of Uranus and Neptune, the polar flattening of Mars, and the observations of Schiaparelli, are somewhat in arrear; and it may be the case that those more intimately conversant with the subject would estimate the

comparative value of the evidence somewhat differently. He has taken a very commendable degree of pains in collecting the opinions of former writers; though we have met with no notice of worthy old Derham, or the quick-eyed but fanciful Gruithuisen; but the natural result is the revival of a good deal of antiquated matter that can hardly claim a hearing before a modern tribunal; such as the assumptions of the Cosmotheoros (which by the way he invariably cites as "Cosmothereos") or the affected *niatseries* of Fontenelle. In fact, excepting for those who would find interest or amusement in specimens of almost all that has been said upon the subject, however absurdly nonsensical, or needlessly pugnacious, the book would gain by a process of winnowing and compression and "weighting," if we may be permitted to use a technical expression. And there can be no question as to the advantage of a more careful revision of the press.

As regards the author's own share, there is much deserving of attention. He writes in an excellent spirit; in espousing the negative side of the question, there is no unfairness towards his opponents; and though some of his arguments carry little weight—for instance that drawn from what seems to him the "dismal," "horrible," "terrifying" aspect of the moon—others are well considered and expressed; and some collateral questions are handled in a way which demands attention, and will well repay it. With regard to the point in hand, if the present volume may not be thought to have done much to decide the controversy, it may be doubtful whether any future successor may do much more. The matter is in reality out of reach. The data are insufficient; and we venture to doubt whether any future generation may be able to attain more satisfactory ones. Long-continued and patient investigation may be fairly expected to throw some light upon the supposed final quiescence of the lunar surface; and possibly on the existence, under certain circumstances, of slight obscurations which might indicate the existence of a very attenuated atmospheric envelope; but this would still leave us at an immense and hopeless distance from any certain proof of habitation. As to the other heavenly bodies our position is worse still. The observations of Schiaparelli, supported to some extent by those of others, and at any rate deserving of respectful attention, tend to divest Mars of some of his supposed similarity to our own globe; and the conclusions hitherto attempted to be drawn as to the condition of the other planetary surfaces are, we venture to think, still less satisfactory. Opinion at present can be little better than conjecture; and it is uncertain at the best whether it will ever be permitted to us to make a further advance. The most ingenious analogical reasoning is not demonstration, and the decision of the finest telescopes would be invoked in vain. An interesting inquiry might be entered upon as to the prospects of opticians and observers; the conclusion possibly might be that their future is somewhat cloudy and obscure. At least we might venture to predict, from past experience, that the accomplished solution of any one of the mysteries which now confront us would only prove a prelude to problems still more insoluble, and proof still more convincing of the comparatively bounded character of all human knowledge.

OUR BOOK SHELF

United States Commission of Fish and Fisheries.

Part vii. Report of the Commissioner for 1879.

THE contents of the present volume, embracing details of the work done by the United States Fishery Commissioner for the year 1879, are quite as varied and even of greater interest, if that be possible, than the preceding reports. The specific objects of the methodical inquiry which has now been going on for over twelve years, has for its object to report progress in regard to the propagation of food-fishes in the waters of the United States, as also to afford information as to the decrease in the stock of food-fishes. As has been already stated in the columns of NATURE, in which previous reports have been reviewed, the inquiry which has been so long in progress is being conducted in a thorough and searching way; it embraces the consideration of every topic calculated to throw light on the economy of the American fisheries. Nothing that can be deemed illustrative is neglected—the literature devoted to the natural history of food-fishes, or to descriptions of the fisheries of other countries, especially those of Europe, has been largely utilised in preparing the reports, with the result of making the volumes which have been issued a perfect encyclopædia of fishery information. The contents of the present report embrace a full account of the work overtaken in 1879 and the early part of 1880. The fishes which have been more particularly dealt with in the period noted are the Californian Salmon (*Salmo Quinnet*), the Atlantic Salmon (*S. Salar*), the Mountain or "Rainbow" Trout of California (*S. Irideus*), as also the Schoodic Salmon (*S. Salar*, var. *Sebago*). Various details are also given of what has been done in carp culture, as also of experiments made with the Striped Bass (*Roccus lineatus*), and the Shad (*Alosa sapidissima*). This fish is dealt with quite in wholesale fashion, the figures quoted being really marvellous, as many as 16,062,000 of young shad being distributed, a complete record being kept of the places to which they were forwarded; in the previous year the distribution of this fish reached the figure of fifteen and a half millions. Among the distinctive articles contributed to the present volume are some of rare importance; we may refer to that by Prof. Barlow on "The Marine Algæ of New England," which is both interesting and exhaustive; it extends to 210 pages of the volume now before us, and is illustrated by a series of well-executed drawings. Another paper of importance, full of curious information, is that of Mr. A. E. Verrill, "On the Cephalopods of the North-east Coast of America"; it is also profusely illustrated with fine drawings. "The Propagation of the Eel" is a contribution which is sure to attract attention; the article is by Dr. Otto Hermes, and was read before the German Fishery Association; although brief it contains many features of interest in connection with the natural history of the curious animal of which it treats, and describes most distinctly the differences of the two sexes. The author of this paper announces that the old eels, both males and females, die soon after the spawning season; "the extraordinarily rapid development of their organs of generation exhausts them to such a degree that they die soon after having spawned." This is the reason why they are never seen to return to the rivers. Among the miscellaneous contents of the present report will be found instructive essays on the food of marine animals, by Prof. E. Möbius. In the appendix will be found a very readable account of the herring fisheries of Iceland, as also a short treatise on the fisheries of the west coast of South America. One of the most scientific papers which is given is one containing a reprint of a series of extracts from the investigations of the Commission for the Scientific Examination of the German Seas—it contains much that will prove of interest both to naturalists and economists. It may be safely said alike of the